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# Pesticide Fact Sheet Number 64
# Bentazon and Sodium Bentazon

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

17. Document Analysis a. Descriptors

Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, Science Findings

b. Identifiers/Open-Ended Terms

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EPA

# Pesticide Fact Sheet

**Name of Chemical:** BENTAZON AND SODIUM BENTAZON
**Reason for Issuance:** REGISTRATION STANDARD
**Date Issued:** September 30, 1985
**Fact Sheet Number:** 64

1. Description of chemical

Common Names: Bentazon

Sodium bentazon (= sodium salt of bentazon)

Chemical Name: 3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide

3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide, sodium salt of

Trade names for Federal Section 3 Registered Products:

Manufacturing-use product: "Bentazon Manufacturer's Concentrate" (EPA Registration No. 7969-42)

End-use product (single active ingredient): "Basagran" Postemergence Herbicide" (EPA Registration No. 7969-45)

End-use product (combined with atrazine): "Laddock" Postemergence Herbicide" (EPA Registration No. 7969-54)

NOTE: All three of the above products have sodium bentazon as the active ingredient.

EPA Chemical Code: Bentazon: 275200

Sodium bentazon: 103901

Chemical Abstracts Service (CAS) Registry Number:

Bentazon: 50723-80-3

Year of Initial Registration: 1975

Pesticide Type: Heterocyclic nitrogen herbicide

Producer Marketing in U.S.: BASF Wyandotte Corporation

2. Use patterns and formulations

Application sites:

soybeans, rice, corn, sorghum, peanuts, beans (dry or succulent), peas (dry or succulent), established peppermint and spearmint, established ornamental turf.

The only additional site under Section 24(c) (special local need) registration is Bohemian chili peppers.

Percent of Particular Crops Treated with the Pesticide as of 1984:

| | |
|---|---|
| soybeans | 20% |
| rice | 10% |
| dry beans and peas | 5% |
| peanuts | 2% |
| corn | <1% |

Percent of Pesticide Applied to Particular Crops as of 1984:

| | |
|---|---|
| soybeans | 96% |
| corn | 2% |
| rice | 1% |
| dry beans and peas | <1% |
| peanuts | <1% |

Types and Methods of Application:

Sodium bentazon is applied, by ground or air, as a broadcast foliar spray after the crop and weeds have emerged from the soil. It is used to control selected broadleaf weeds and sedges only.

Application Rates:

Rates, from 0.75 lb active ingredient (a.i.)/acre to 2 lb a.i./acre, vary by crop, geographic region, target species, and site conditions.

Types of Formulations:

The manufacturing-use product is a 46% sodium bentazon liquid. Basagran™ Postemergence Herbicide is a "soluble liquid concentrate" containing 42% sodium bentazon. Laddock™ Postemergence Herbicide is a "flowable liquid concentrate" containing 18.52% sodium bentazon and 16.96% atrazine.

Usual Carriers:

The usual carrier is water. An oil concentrate is used under certain conditions.

3. Science Findings

Chemical Characteristics:

Technical grade bentazon (isolated before formation of sodium bentazon) is an odorless, non-volatile solid with a melting point of 137-139°. It's solubility (g/100 g solvent, 20°C) is 0.05 in water and 150.7 in acetone. Sodium bentazon is considerably more soluble in water than bentazon, with a solubility of 230 g/100 g in water.

Mammalian Toxicology Characteristics:

Acute toxicity:

Sodium bentazon is in Toxicity Category III (defined in 40 CFR 162.10), based upon

acute oral toxicity in the rat and acute dermal testing in the rat. An acute inhalation study is supplementary (valid but does not meet EPA guideline requirements) and will need to be repeated.

Subchronic toxicity:

Subchronic data are supplementary (90-day rat feeding study and 13-week dog study; bentazon) or invalid (21-day dermal study; sodium bentazon), and will require replacement. Compound-related effects were seen at 300 and 3000 ppm test levels in the dog study (numerous effects at 3000 ppm; prostatitis at 300 ppm was basis of lowest-effect-level of 300 ppm and no-effect level of 100 ppm). A one year dog study is required for hazard assessment.

Chronic Toxicity:

All chronic toxicity data for bentazon are supplementary or invalid, and will require replacement. 24-month rat and 18-month mouse studies have been invalidated and a "for cause" laboratory audit requested, due to substantial deficiencies. In a supplementary mouse oncogenicity study, no specific clinical or pathological symptoms could be associated with bentazon exposure.

A rat 3-generation reproduction study found no compound-related effects for bentazon up to a dietary level of 180 ppm. However, without effects at the highest dose, the dose selection is considered inadequate.

The available rat and rabbit teratogenicity studies are inadequate, but do not suggest that bentazon is a potent teratogen or fetotoxic agent. Terata were observed in one rat study at a dose of 200 mg/kg/day, but the utility and validity of these data are in question. Additional teratology studies in the rat and rabbit are required.

A variety of mutagenicity studies (analytical grade bentazon; or sodium salt) have been reviewed, but none are adequate for regulatory purposes. This is also the case for metabolism studies with labeled bentazon.

Physiological and Biochemical Behavioral Characteristics:

Mechanism of pesticidal action:

Foliar application of sodium bentazon results in photosynthesis inhibition in susceptible species. Visible injury to the treated leaf surface usually occurs in 4-8 hours, followed by plant death.

Foliar absorption and translocation:

Bentazon applied post-emergence to young plants may be absorbed and translocated from the site of application. The degree of translocation depends on the plant species. Whether translocated or not, bentazon is rapidly metabolized, conjugated, and incorporated into natural plant components.

Metabolism in plants and animals:

The metabolism of bentazon in tolerant plants is partially understood. The 6-hydroxy and the 8-hydroxy metabolites are included with bentazon in the tolerances on crops. Further work is necessary to characterize other metabolites.

The metabolism in animals is not understood as the acid hydrolysis procedure was not run on any of the methanol extracts of eggs and poultry tissues. However, in animals there is no hydroxylation of bentazon as in plants. Based on available information, the residues in animals consist of the metabolite AIBA and bentazon, and tolerances for residues in animal products should be expressed in terms of these combined residues.

Environmental Characteristics

Decomposition:

Based on available, validated data, bentazon appears to be stable to hydrolysis, but photodegrades in water with a half-life of <24 hours. It also photodegrades on soil. Under aerobic conditions in lab and field, bentazon degrades with a half-life of <1 month in soil.

Bioaccumulation:

Bentazon residues accumulate in the tail meat and viscera of crayfish with bioconcentration factors of <10X.

Surface and ground water contamination concerns:

Bentazon is very mobile in soil but the relatively rapid degradation is expected to prevent groundwater contamination. An aged leaching study is needed to determine the potential for metabolites to contaminate groundwater. Bentazon does have the potential to contaminate surface water because of 1) its mobility in runoff water, for all crops and 2) its rice use pattern that involves either direct application to water or application to fields prior to flooding.

Ecological Effects

Hazards to fish and wildlife:

Technical bentazon is considered slightly toxic to birds based on subacute dietary testing. Formulated bentazon is considered slightly toxic to birds based on acute oral testing with a 50% a.i. wettable powder. Avian reproduction testing did not show effects up to the highest dietary level tested, but the studies were found to lack vital information and do not presently meet EPA guidelines.

Technical bentazon is characterized by EPA as practically nontoxic to both coldwater and warmwater fish, and slightly toxic to aquatic invertebrates, based on review of acute testing. Formulated bentazon is considered practically nontoxic to coldwater and warmwater fish based on acute testing with a 48% a.i. liquid product.

Applications of bentazon on registered use sites are considered unlikely to result in acute hazard to most nontarget organisms because of its generally low toxicity, based on available data, and low application rates. However, a final risk assessment is deferred due to lack of critical environmental chemistry data and certain ecological effects data.

Potential problems related to endangered species:

Biological opinions (covering all registered pesticides) have been received from the U.S. Fish and Wildlife Service Office of Endangered Species (OES) for three of the crops for which sodium bentazon is registered: corn, sorghum, and soybeans. To avoid jeopardy to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus), OES indicates that herbicides should be prohibited from designated areas in California in order to protect the host plant, elderberry (Sambucus spp.). Labeling developed by EPA to implement this prohibition is described below.

The above opinions also stated that "...to avoid jeopardy to Solano grass...the use of any herbicides toxic to graminoides should be prohibited within..." certain defined geographic areas of California, because of concerns with spray drift and runoff from agricultural areas. Solano grass (Tuctoria (= Orcuttia) mucronata) is an endangered plant species found in a vernal lakebed in Solano County, California. Since no grass species are claimed on existing labeling to be controlled with sodium bentazon and the herbicide is used on various grass crops, Ecological Effects Branch (with informal consultation with OES) did not consider there to be a threat to Solano grass from the registered use of this chemical. Subsequently, information has been located indicating that sodium bentazon may affect certain germinating grass species with direct exposure at full dosage rates, but that it does not affect grasses after germination. Solano grass germinates in March and April. The earliest planting date for corn, sorghum, or soybeans is for corn, which can be planted as early as April 15. Since sodium bentazon is applied postemergence to the weeds, there may be little opportunity for an application that could affect Solano grass. Further consultation with OES will be initiated. Label restrictions, as above, and/or plant protection data requirements (under 40 CFR § 158.150) may be imposed.

An oyster study and further environmental chemistry data are required, in part, to evaluate whether there is any hazard to endangered mussel species from sodium bentazon use.

The Agency is not aware of any other data which would suggest that the risk criteria of § 162.11 have been met or exceeded for the uses of sodium bentazon at the present time.

## TOLERANCES

In the United States, tolerances are currently established in 40 CFR §180.355 for combined residues of bentazon (3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one-2,2-dioxide) and its 6- and 8-hydroxy metabolites in or on agricultural commodities as follows:

| Commodity | parts per million |
|---|---|
| Beans (except soybeans), dried | 0.05 |
| Beans (exc. soybeans), dried, vine hays | 3 |
| Beans (exc. soybeans), forage | 3 |
| Beans, lima (succulent) | 0.05 |
| Beans, succulent | 0.05 |
| Bohemian chili peppers | 0.5* |
| Corn, fodder | 3 |
| Corn, forage | 3 |
| Corn, grain | 0.05 |
| Corn, fresh (incl. sweet K+CWHR) | 0.05 |
| Mint | 1 |
| Peanuts | 0.05 |
| Peanuts, hay | 3 |
| Peanuts, hulls | 0.3 |

| | |
|---|---|
| Peanuts, forage | 3 |
| Peas (dried) | 0.05 |
| Peas (dried), vine hays | 3 |
| Peas, forage | 3 |
| Peas, succulent | 0.5 |
| Rice | 0.05 |
| Rice, straw | 3 |
| Sorghum, fodder | 0.05 |
| Sorghum, forage | 0.20 |
| Sorghum, grain | 0.05 |
| Soybeans | 0.05 |
| Soybeans, forage | 3 |
| Soybeans, hay | 0.3 |

and

b) combined residues of bentazon (3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one-2,2-dioxide) and its metabolite 2-amino-N-isopropyl benzamide in raw agricultural commodities as follows:

| Commodity | parts per million |
|---|---|
| Cattle, fat | 0.05 |
| Cattle, mbyp | 0.05 |
| Cattle, meat | 0.05 |
| Eggs | 0.05 |
| Goats, fat | 0.05 |
| Goats, mbyp | 0.05 |
| Goats, meat | 0.05 |
| Hogs, fat | 0.05 |
| Hogs, mbyp | 0.05 |
| Hogs, meat | 0.05 |
| Milk | 0.02 |
| Poultry, fat | 0.05 |
| Poultry, mbyp | 0.05 |
| Poultry, meat | 0.05 |
| Sheep, fat | 0.05 |
| Sheep, mbyp | 0.05 |
| Sheep, meat | 0.05 |

*The misprinted tolerance of 0.5 ppm for Bohemian chili peppers will be corrected to read 0.05 ppm.

Tolerance reassessment cannot be conducted because of toxicology and residue chemistry data gaps.

International Tolerances:

There are 0.1 ppm Canadian tolerances for bentazon on soybeans, beans, peas, corn, rice, and peanuts. Presently, there are no Mexican or Codex Alimentarius tolerances for bentazon.

## 4. Summary of Regulatory Position and Rationale

The available data do not indicate that any of the risk criteria listed in § 162.11 (a) of Title 40 of the U.S. Code of Federal Regulations have been met or exceeded for the uses of sodium bentazon at the present time. However, substantial data gaps exist (see below). Under FIFRA §3(c)(2)B), the registrant must provide or agree to develop this data to maintain the existing MP registration or to permit new registrations of substantially similar sodium bentazon MPs.

The Agency will complete its hazard evaluation, or determine what further data are necessary to do so, upon review of the data being required under this Registration Standard. The Agency will determine at that time if such data will affect the registrations of bentazon. If such review determines that criteria for determinations of unreasonable adverse effects are met or exceeded (as specified under §162.11), a rebuttable presumption shall arise that a a notice of intent to cancel registration(s) pursuant to FIFRA §6(b)(1) (or a notice of intent to hold a hearing to determine whether the registration(s) should be cancelled) may be issued. If, at any time, review of the data indicates that an imminent hazard (as defined by FIFRA § 2(1)) is posed by continued bentazon use, immediate suspension procedures may be initiated as per FIFRA §6(c)(1).

No new uses of sodium bentazon will be permitted until the data base is adequate to complete a hazard assessment. As per Conditional Registration Interim Final Regulations (FR Vol. 44, No. 93, May 11, 1979), no new uses or new products may be registered without "data sufficient to allow the Agency to determine that approval of the application would not cause a significant increase in the risk of unreasonable adverse effects on the environment". For bentazon, the entire subchronic and chronic toxicology data base (required to evaluate hazards to humans/domestic animals from existing uses) is invalid or otherwise inadequate, and thus totally insufficient to evaluate any new uses. The Agency is unable to complete a tolerance reassessment of bentazon because of these gaps, as well as residue chemistry data gaps.

The Agency is unable to fully assess potential human exposure, potential for groundwater contamination, or complete an ecological effects hazard assessment of existing sodium bentazon uses because of exposure assessment/environmental chemistry data gaps. There are also certain product chemistry, wildlife/aquatic organism, and nontarget insect data gaps that prevent full assessment of existing use.

Clarification or verification of all test materials used in studies submitted by the registrant is required. The Agency reserves the right to impose additional testing of either bentazon or sodium bentazon following review of this information and/or review of new studies submitted to fulfill data gaps identified in this Standard.

All manufacturing-use and end-use products containing sodium bentazon must bear appropriate labeling as specified in 40 CFR §162.10. The following statements are also required. All labeling changes must appear on all products released for shipment by September, 1986. All labeling changes must appear on all products in channels of trade by September, 1987.

Manufacturing-Use Products

"Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or public waters unless this product is specifically identified and addressed in a National Pollutant Discharge Elimination System (NPDES) permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the U.S. Environmental Protection Agency."

When citing the bentazon equivalent, the chemical name for bentazon should be written as "3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2 dioxide".

End-Use Products

"Do not graze treated corn fields for at least 12 days after the last sodium bentazon treatment."

"Do not graze treated peanut fields for at least 50 days after the last sodium bentazon treatment."

"Do not rotate crops used for food or feed, which are not registered for use with sodium bentazon, on areas previously treated with this chemical."

"Do not use sodium bentazon on rice fields in which the commercial cultivation of catfish or crayfish is practiced."

"Do not use water containing bentazon or sodium bentazon residues from rice cultivation to irrigate crops used for food or feed unless sodium bentazon is registered for use on these crops."

For all uses except rice: "Do not apply directly to water or wetlands. Do not contaminate water by cleaning of equipment or disposal of wastes."

For rice use: "Do not contaminate water by cleaning of equipment or disposal of wastes."

For corn, soybean, and sorghum uses:

"Notice: It is a violation of federal laws to use any pesticide in a manner that results in the death of an endangered species or adverse modification of their habitat.

"The use of this product may pose a hazard to certain federally designated endangered species known to occur in specific areas within the CALIFORNIA counties of Merced, Sacramento, and Solano. Before using this product in these counties you must obtain the EPA Endangered Species Bulletin specific for these areas. The bulletin (EPA/ES-85-6) is available from either your County Agricultural Extension Agent, the Endangered Species Specialist in your State Wildlife Agency Headquarters, or the Regional Office of the U.S. Fish and Wildlife Service (Portland, Oregon). THIS BULLETIN MUST BE REVIEWED PRIOR TO PESTICIDE USE. THE USE OF THIS PRODUCT IS PROHIBITED IN THESE COUNTIES UNLESS SPECIFIED OTHERWISE IN THE BULLETIN."

When citing the bentazon equivalent, the chemical name for bentazon should be written as "3-(1-methylethyl)-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2 dioxide".

Summary of Major Data Gaps:

There are numerous generic data gaps in the areas of product chemistry, residue chemistry, environmental fate, and ecological effects.

Generic toxicology data gaps and time frames for submittal are as follows:

| | |
|---|---|
| Acute inhalation toxicity—rat | 9 months |
| 90-day feeding—rodent | 15 months |
| —non-rodent (dog) | 18 months |
| 21-day dermal—rabbit | 12 months |
| Chronic toxicity—rodent | 50 months |
| —non-rodent (dog) | 50 months |
| Oncogenicity—rat (preferred) | 50 months |
| —mouse (preferred) | 50 months |
| Teratogenicity—rat | 15 months |
| —rabbit | 15 months |
| Reproduction—rat (2-generation) | 39 months |
| Mutagenicity—gene mutation (Ames Test) | 9 months |
| —structural chromosomal aberration | 12 months |
| Mutagenicity—other genotoxic effects | 12 months |
| General metabolism (using bentazon and sodium bentazon) | 24 months |
| Dermal Penetration | 12 months |

Product-specific data on the manufacturing-use product include product chemistry data and two acute toxicology studies.